Space Weather Technical Forecast

Issued on Monday, 01 November 2021 at 00:14 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Slight chance of G1/Minor Storm intervals at first. Slight chance of M-class flares.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity was low, with several C-class flares, mostly emanating from AR2887 (Cso/Beta) in the southwest. This has seen significant simplification over the past few days as it transits towards the southwest limb, and saw some penumbral decay in its trailing group through the past 24 hours. There are currently three further active regions in view, with AR2892 (Axx/Alpha) in the northwest decaying to a small uni-polar spot. AR2891 (Eac/Beta) in the northeast saw longitudinal extension, but with fading of some of its trailing spots, and AR2893 (Hsx/Alpha) moved into view around the northeast limb. A C3 flare just after 31/0700 UTC from AR2891 appears to have generated a CME, analysis of which suggests a possible glancing blow at Earth late on 3rd or early 4th November. No other Earth-directed CMEs were obvious in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind parameters, as measured by DSCOVR at L1, were indicative of the arrival of a CME just after 31/0900 UTC, that departed the sun on 28th Oct. Speeds were at mostly background levels to start, but became more generally slightly elevated from 31/0915 UTC, with a peak of 464 km/s at 31/1907 UTC, and density values saw a sudden rise from average to above average values at 31/0915 UTC. Total IMF Bt saw a jump from weak to moderate levels around this time, reaching 13 nT at 31/1103 UTC, before falling back to below average later. Its north-south component Bz was predominantly negative through the period, with a southward deflection of -11 nT at 31/1136 UTC recorded after the CME arrival. Phi angle was in a predominantly positive (away from sun) orientation. Resultant geomagnetic activity was Quiet to Active (Kp0-4).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured by GOES-16 continued on a declining trend below the S1 level. The high energy electron flux (greater than 2 MeV) was predominantly at background levels with the associated 24-hour electron fluence below the Active (1e8 integrated pfu) threshold, and with 1.22e6 integrated pfu recorded at 01/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar Activity is forecast is forecast to be low over the next 4 days with a slight chance of further M-class flares, mainly from AR2891.

Solar Wind / Geomagnetic Activity: Slightly elevated solar winds in the wake of CME impacts on 31st Oct are expected to return to background levels by day 2 (2nd Nov), but see a further enhancement under coronal hole influences from day 3 (3rd), perhaps combined with further weak CME effects. Unsettled to Active geomagnetic activity at first, is expected to become Quiet to Unsettled by day 2, and Quiet by day 3 (3rd). Unsettled conditions then again likely by day 4, with isolated Active intervals.

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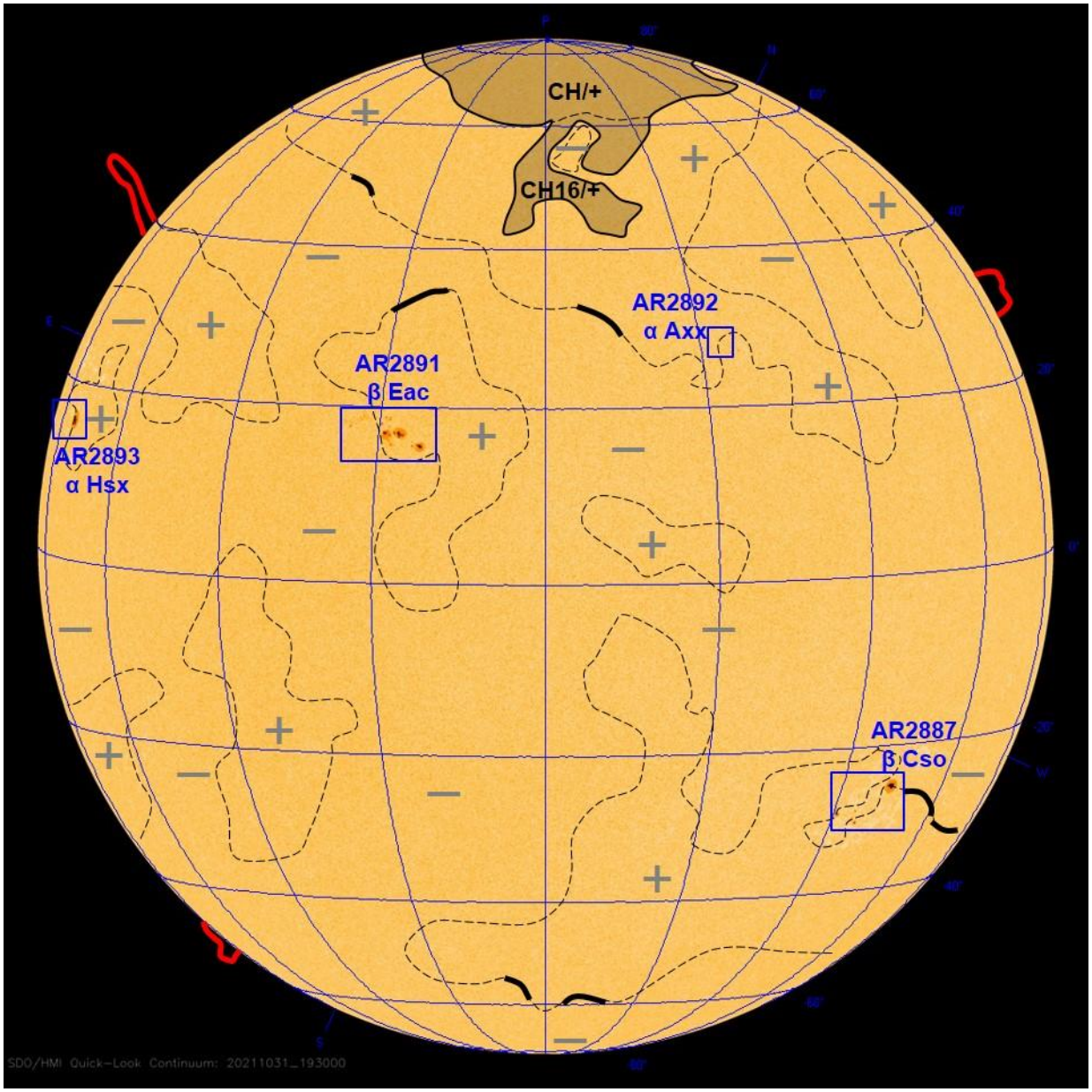
Energetic Particles / Solar Radiation: The high energy (greater than 10 MeV) proton flux is expected to be below the S1 minor storm level, decreasing to background values by day 2 (2nd). The high energy electron flux (greater than 2 MeV) is forecast to be at mostly background to moderate levels, but perhaps nearing high levels through the diurnal cycle from day 2. The associated 24 hour fluence is expected to remain largely below the Active (1e8 integrated pfu) level, but see a rising trend through the period.

Figure 1. Solar Analysis Valid 31/2000 UTC



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

Earth is currently under residual influences of a CME that arrived on 31st October, albeit more limited than originally anticipated. This brought slightly elevated solar wind speeds, but these likely to return to background levels by day 2 (2nd). Generally Unsettled geomagnetic activity expected to start, with isolated Active intervals, but becoming generally Quiet to Unsettled by day 2, and Quiet by day 3 (3rd).

By day 4 (4th) solar winds are likely to become enhanced again, with Earth expected to make some connection with a high speed stream from positive CH16, a southern extension of the northern polar crown. STEREO A Mag & PLASTIC data show a significant increase in speeds on 31st Oct, likely under this coronal hole's influence, which would be expected just over three days later at Earth. Also, a CME that departed the sun on 31st Oct may give a glancing blow at Earth late on day 3 or early day 4. These two features suggest an increase in solar wind speeds and geomagnetic activity again on days 3 and 4, with Unsettled to Active intervals likely.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Date/time 21.5R (UTC)	Halo: Full or Partial	Source	Source Location	Estimated Speed	Estimated Arrival Time	Comments
31/1628	Partial	C3 flare	AR2891	490 km/s	03/2100UTC	Possible glancing blow

Figure 2: Enlil modelling of the 31st Oct CME, possible glancing blow at Earth late3rd or early 4th.

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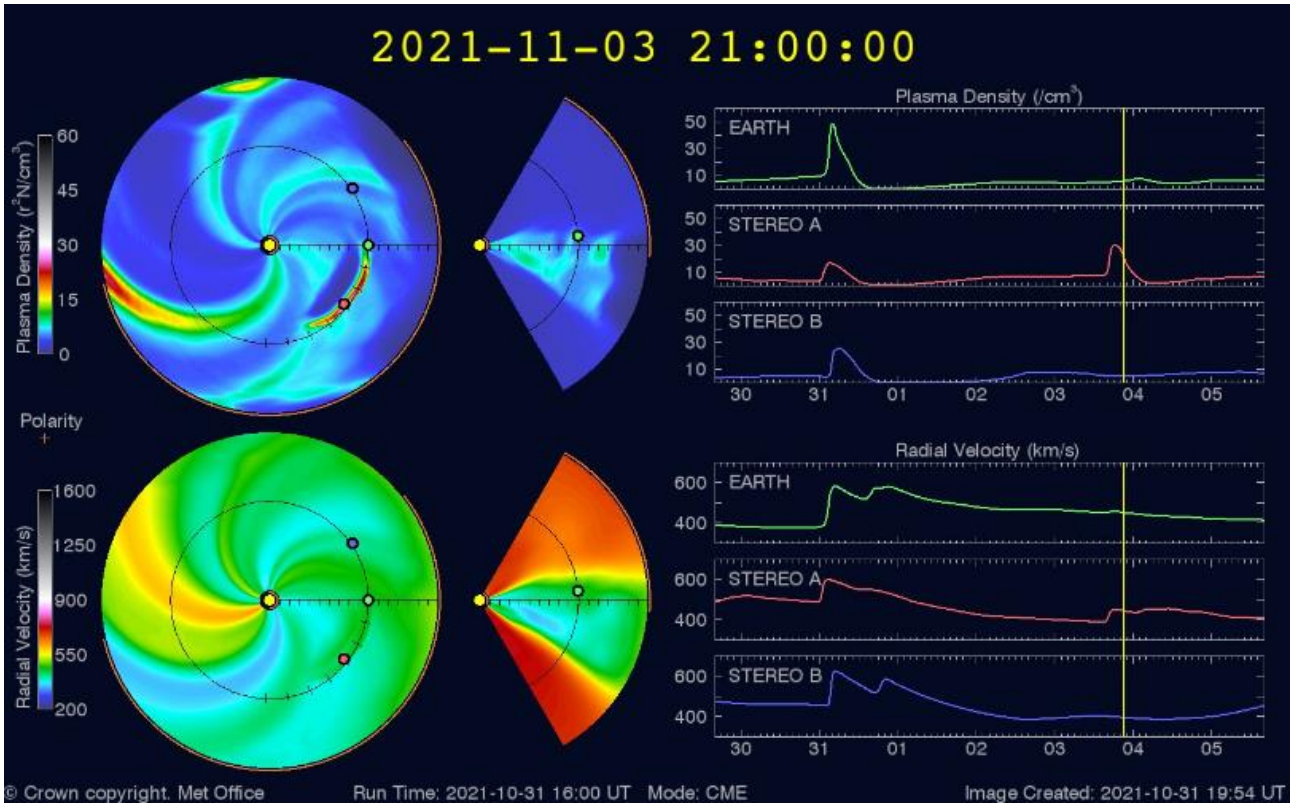

Radio Blackouts - X-Ray Flares:

Solar activity is currently at low levels, with any flare activity most likely from AR2887 (Cso/Beta) in the southwest. This has seen significant simplification over the past few days as it transits towards the southwest limb, but a slight chance of M-class flares is maintained through much of the period. Of the other three further active regions in view, only AR2891 (Eac/Beta) in the northeast is considered to have potential for increased flare activity at this time.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	20	20	20	10
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 3: Past 24 hours GOES X-Ray flux

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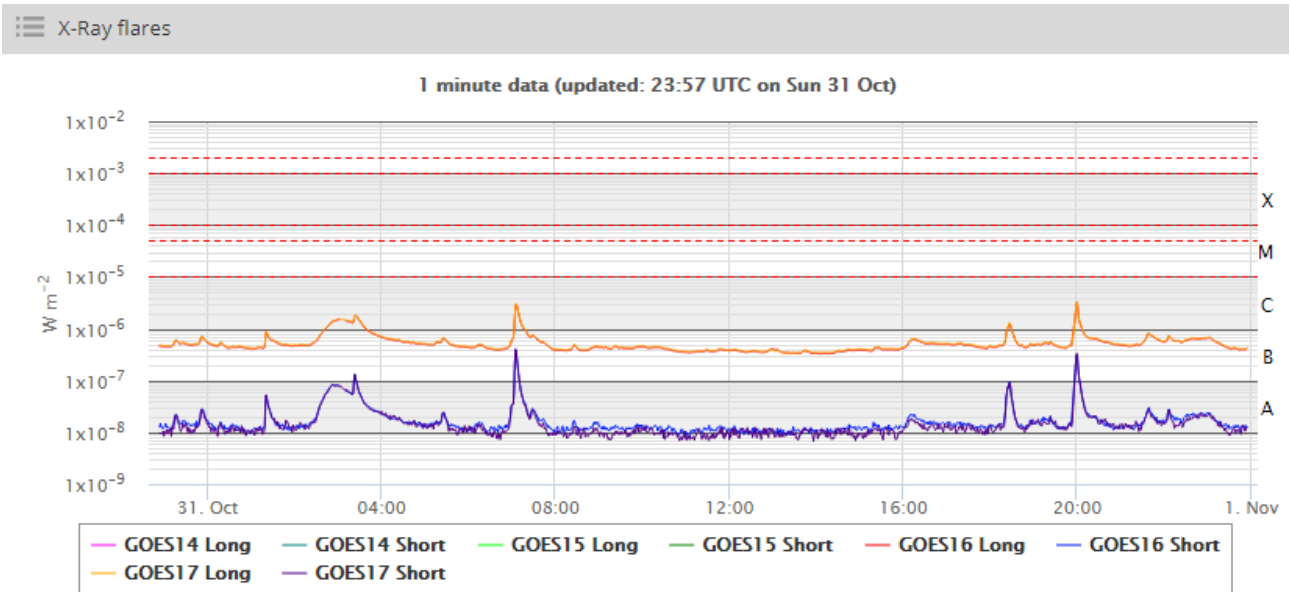
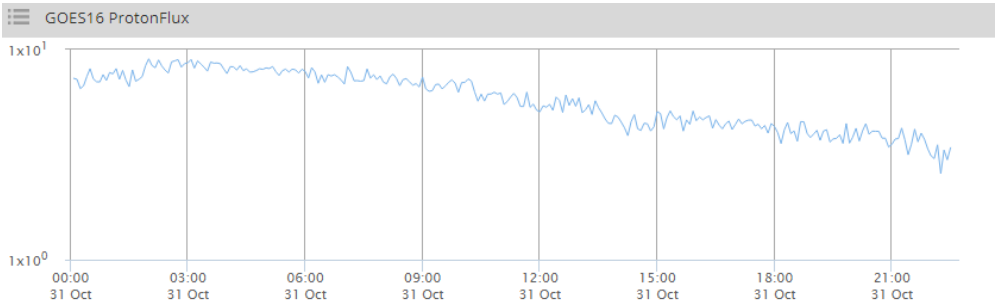


Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) as observed by GOES-16 is now below S1/Minor storm levels, and expected to continue on a downward trend towards background levels by day 2. Therefore no solar radiation storms are anticipated during this forecast period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	Yes	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Declining proton flux over the past 24 hours.



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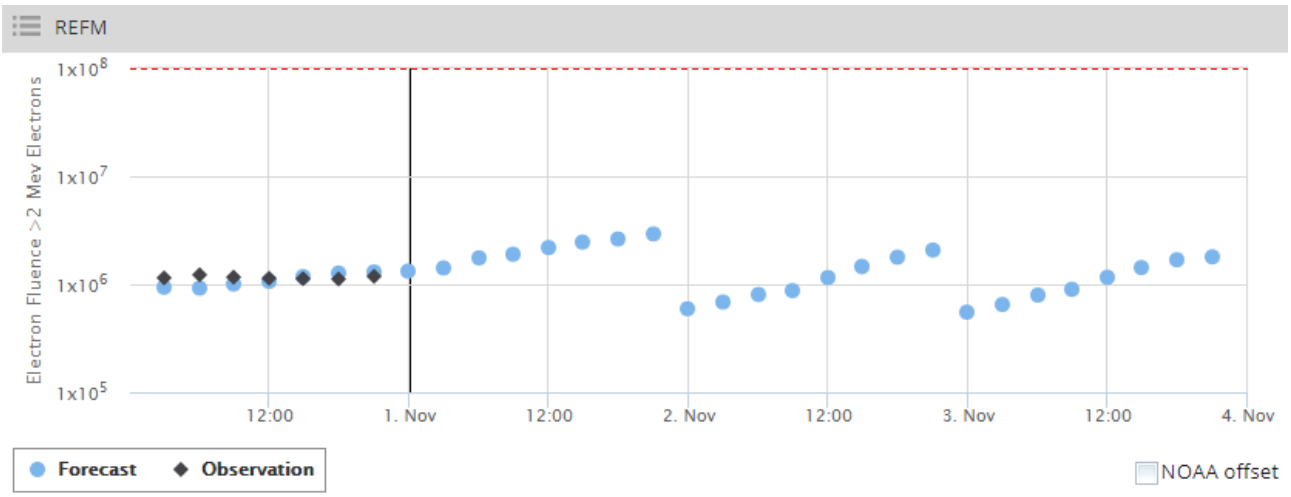
High Energy Electrons Event (≥ 2MeV):

The high energy electron flux (greater than 2 MeV) as observed by GOES-16 at GEO is currently at mainly background levels, but some increase in electron counts is likely on days 1 and 2 (1st and 2nd), with slightly elevated winds to start as a result of recent CME arrival. However, any increased geomagnetic activity associated with a possible glancing blow from a further CME late on day 3 or early day 4 (3rd or 4th), or anticipated limited high speed stream connection on day 3 (3rd) would be expected to suppress counts again.

Fluence levels are likely to remain below the active threshold (1e8 integrated pfu) through this period, as suggested by latest REFM output, although a rising trend is likely, at least through days 1 and 2.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	5	20	20	10
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: Latest REFM output.



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